REMARKS/COMMENTS

Claims 1-16, 38 and 43 have been canceled. Claims 17-37, 39-42 and 44 and new Claim 45 remain active in the case. Claims 17-25 stand withdrawn from consideration. Reconsideration is respectfully requested.

Applicants' representative wishes to thank Examiner Langel for the helpful and courteous discussion of May 11, 2004. As a result of the discussion it is believed that the issues in the case have been clarified and that the prosecution of the case has been materially advanced.

Applicants' representative wishes to thank Examiner Langel for the helpful telephonic discussion of the issues in the discussion of June 17, 2004.

The present invention relates to a composite oxide powder which is useful as a catalyst support.

Claim Amendments

Claim 32 has been amended to clarify that the composite oxide material is calcined, the particular porosity characteristics of the oxide material being established as a result of the aging treatment of the invention. Further, the claim, as well as Claims 44 and 45 has been limited in scope by recitation of the transitional phrase of "consisting essentially of."

Claim 35 has been amended to clarify the meaning of the claim. No new matter is believed to have been introduced into the claim by the amendments that have been made.

Claim 38 has been canceled in favor of new Claim 45 which specifies the combination of the three metal oxides of M_1, M_2 and M_3.

Claim 43 has been canceled and the porosity limitations of this claim have been placed into each of Claims 32 and 44, as well as new Claim 45. Entry of the amendments is respectfully requested.

Invention

The present invention is directed to a composite oxide powder which consists essentially of particles of an oxide of metal M_1 (Ce) and an oxide of metal M_2 that is Al, Ti or Si, which does not dissolve in said oxide of metal M_1,wherein the cerium oxide constitutes more than 50 % by wt of the composite oxide powder. (In Claim 44 the amount of cerium oxide is at least 60 % by wt.) Further, the composite which is obtained after calcination at 600° C for 5 hours is such that the porosity of the composite oxide is defined in terms of pores in the size range of 3.5-100 nm in diameter having a volume of 0.13 cc/g or more while the pores in the same size range of 3.5-100 nm in diameter have a volume of 0.10 cc/g or more attained at a calcination temperature of 800°C for 5 hours.

In another embodiment of the invention as claimed in newly submitted Claim 45, an oxide M_3 is incorporated in the mixed composite oxide which dissolves in either or both of the oxides of metals M_1 and M_2. The composite powder of the present invention results in a catalyst which exhibits excellent durability by suppressing noble metal grain growth during use of the catalyst at high temperature over long periods of time.

Prior Art Rejection, 35 U.S.C. § 103

Claims 26-24 stand rejected based on 35 USC § 102(b) or 35 U.S.C. § 103(a) as anticipated by or rendered obvious over Suzuki et al, U.S. Patent 6,150,288 or Rajaram et al, U.S. Patent 5,993,762. This ground of rejection is respectfully traversed.

It is clear that the Suzuki et al patent is relevant to the present invention, because it discloses a composite oxide which supports a catalytically active metal for the treatment of exhaust gases that are discharged from the internal combustion engine. As stated in the Summary of the Invention, the composite oxide is comprised of crystallites of oxides of cerium and/or zirconium and secondary particles thereof. More specifically, as disclosed at column 2, lines 25-30, the composite oxide is composed of oxides of at least one of cerium or zirconium and aluminum. The composite oxide of the patent can be formed by mixing of solutions of salts of several elements at least one of which is cerium or zirconium and the other is aluminum. Upon mixing, precipitation and then firing of the material obtained, a composite oxide is formed. Although the combination of aluminum oxide/cerium oxide is a possibility of various mixed oxides within the scope of the Suzuki et al. disclosure as taught at column 3, line 30 of the patent, there is no teaching or suggestion of the pore size range within the meso pore size range of 3.5-100 nm in diameter, as volume is influenced by the time and temperature of calcination conditions. Moreover, where the text of the patent provides detailed information concerning composite oxide embodiments of the reference in the examples, virtually all of the examples show a mixed oxide of cerium, zirconium and aluminum oxides, which combination of oxides is **not** within the scope of present Claims 26 and 32 by virtue of the restricting language in Claim 32 (also Claims 44 and 45). Moreover, there is no information provided in the patent of any specifics of the Al_2O_3/CeO_2 combination

taught in the patent. Not only is no mention made of the porosity of the composite oxide support material of the reference, there is absolutely no teaching or suggestion of the porosity characteristic set forth in the present claims for the mesopores of a composite oxide that after calcination of a composite oxide at a temperature of 600° C for 5 hours, the porosity of the composite oxide is defined in terms of pores in the size range of 3.5-100 nm in diameter having a volume of 0.13 cc/g or more while when the composite oxide is calcined at a temperature of 800°C for 5 hours, the pores in the same size range of 3.5-100 nm in diameter have a volume of 0.10 cc/g or more. It must be observed that in Examples 1, 3 and 4, the precipitate was aged for 2 hours, and that, as described in paragraphs [0102] to [0104] of the text, as a result of the aging treatment of the invention, control of the size of the pores of the material can be achieved to a most suitable size. In fact, many pores of the small size meso pores can be maintained in the composite oxide even after calcination at the temperatures indicated. On the other hand, in Suzuki et al whose process involves general copreciptiation, there is no aging step. Thus, it seems clear that Suzuki et al does not achieve the porosity of the composite oxide that is achieved in the present invention. Accordingly, Suzuki et al does not teach or suggest the present invention.

The Examiner suggests that the porosity values are inherent to the composite oxides of the reference apparently in view of the disclosure of the patent at column 10, lines 15-18 of the subjection of catalysts to an endurance test at 1000°C for 5 hours which is deemed equivalent to the calcination treatment of the present claims. It must be understood that in the process of the invention as set forth in the claims that have been withdrawn from consideration, after precipitation of metal oxide, the precipitate is aged in an aqueous medium in the temperature range of 100 to 200° C. It is only by the aging treatment of the invention

that a composite oxide is achieved that has the specific stated porosity characteristics as described in Examples 1, 3 and 4 and Figs. 3-5 of the text. (After aging of the metal oxide material, the aged oxide, upon calcination at 600° C for 5 hours, has a porosity, defined in terms of pores in the size range of 3.5-100 nm in diameter, of a volume of 0.13 cc/g or more, while the pores in the same size range of 3.5-100 nm in diameter have a volume of 0.10 cc/g or more as attained at a calcination temperature of 800°C for 5 hours.) These porosity characteristics are not achieved by the endurance test described in the reference. Moreover, the endurance test of the reference is a test that is conducted on a completed catalyst that is obtained by supporting a catalytically active metal on a composite oxide material. In other words, the "endurance" of the catalyst in a high temperature, oxidative environment is tested. In fact, the present specification also makes reference to this endurance test as described in paragraph [0108] of page 33 of the text in terms of catalysts of Pt supported on the composite oxides of Examples 7 and 8. (Here the test is conducted at 800° C for 5 hours, not 1000°C.)

As to Claims 27 and 30, Suzuki et al nowhere shows or suggests a solid solution or composite oxide of zirconia and yttria. Accordingly, in view of the above discussion, it is clear that Suzuki et al neither anticipates nor obviates the invention as claimed and withdrawal of the rejection is respectfully requested.

As to the matter of newly presented Claim 45, which is based on previously submitted Claim 38 (now canceled), although indeed a third metal (M_3) oxide component is introduced into the oxide material of metals M_1 and M_2 which dissolves in at least one of the two metal oxides (Claim 39 specifically mentions zirconium oxide), nevertheless, because Suzuki et al contains no teaching or suggestion of the aging of a mixed oxide material in the temperature

range of 100 to 200° C and how the aging treatment affects the porosity of the calcined composite oxide, the composite oxide is materially different from the disclosed and exemplified composite oxides of Suzuki et al which are formed from the metal oxides of cerium, aluminum and zirconium.

As to the matter of the Rajaram et al patent, the same discloses a composite oxide as a support for catalyst employed in the treatment of vehicle exhaust gases. The patent at column 3, lines 10-23 discloses oxides of one or more metals of the group of cerium, zirconium, titanium and tin as composite oxide material which may also be combined with a secondary metal oxide of zirconium, aluminum, lanthanum and barium. From this disclosure it is clear that the closest point at which the reference approaches the present invention as claimed in Claims 26 and 32 is a composite oxide of the oxides of cerium and aluminum, which is the most relevant combination taught by Suzuki et al. In fact, the combination of oxides of cerium and aluminum is the only combination specifically taught by the reference that is within the scope of the present claims. Example 6 of the patent specifically discloses a catalyst of Pd-Pt supported on a composite of the oxides of cerium and aluminum. However, there is absolutely no mention of the porosity of the composite oxide supports in the patent and certainly no mention of porosity as established by the aging treatment of the invention which establishes the small-sized mesopores in the composite oxide so as to secure a sufficient pore volume of the pores. In fact, as pointed out with respect to Suzuki et al, Rajaram et al also only shows a coprecipitation with no aging step in the process. Moreover, the calcination of the composite oxide catalyst of Example 6 of the patent appears to relate the act of calcination to surface area of the catalyst. Porosity is not mentioned. Accordingly,

in view of the above discussion, it is clear that Rajaram et al neither anticipates nor obviates the invention as claimed and withdrawal of the rejection is respectfully requested.

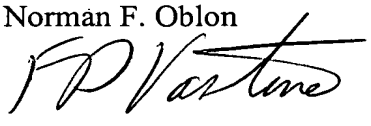
As to the matter of newly presented Claim 45, as discussed above, although indeed a third metal (M_3) oxide component is introduced into the oxide material of metals M_1 and M_2 which dissolves in at least one of the two metal oxides, nevertheless, Rajaram et al does not specifically teach a catalyst support formed from the three different oxides of cerium, aluminum and zirconium, although it is possible to arrive at such a three metal oxide composition from the disclosure of specific oxides at column 3, lines 10-22 of the patent. Moreover, there is absolutely no teaching or suggestion of the aging treatment of a mixed oxide material. Accordingly, the composite oxide of the invention is materially different from the disclosed and exemplified composite oxides of Rajaram et al.

As to Claims 27 and 30, Rajaram et al nowhere shows or suggests a solid solution or composite oxide of zirconia and yttria. Accordingly, withdrawal of the rejections based on the Rajaram et al reference is respectfully requested.

It is now believed that the application is in proper condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.
Norman F. Oblon



Frederick D. Vastine, Ph.D.
Registration No.: 27,013

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/03)
NFO/FDV